



Solid Precipitation Protocol



Purpose

To measure solid precipitation at the Atmosphere Study Site

Overview

Climate studies and Earth System studies require accurate, long term solid precipitation measurements.

Time

5 minutes

Level

All

Frequency

Daily within one hour of local solar noon.

Key Concepts

Change of state
Heat capacity
Density of snow

Skills

Reading a scale
Recording data

Materials and Tools

Meter stick (If your snow tends to be deeper than one meter, you will need a longer measuring pole.)
Snowboard

Prerequisites

None

Background

A snowboard is a thin, flat surface that rests on top of earlier layers of snow. New snow falls on top of it and can be measured with the measuring stick. The board may be made of thin plywood (1 cm or 3/8"). The board should be at least 40 cm by 40 cm in size so that more than one snow-depth measurement can be made. Mark the location of the snowboard so that it can be easily located after it has been covered by a new snowfall.

In most cases a meter stick will be adequate to use as the "measuring pole". However, in regions where the 24 hour snowfall and/or snow accumulated on the ground throughout the winter exceeds 1 meter, a longer measuring stick will be necessary. In these cases, a measuring pole can be made by taking a straight piece of wood and carefully marking off lengths using a ruler and a permanent marker. The pole may be permanently installed as it is often difficult to push a pole vertically through more than 1 meter of snow.

How to Measure Solid Precipitation

1. For your first snowfall, insert the measuring stick vertically into the snow until it rests on the ground's surface. *Be careful not to mistake an ice layer or crusted snow for the ground.* Repeat the measurement in several places where the snow is least affected by drifting. If there is no new snow, enter 0. If the measured depth is between 0 and 0.5 millimeter, enter the letter "T" (for trace).
2. Place the snowboard on top of existing snow and push gently into the snow so that its surface is flush with the snow's surface. Place a flag or other marker nearby to help you locate the snowboard after the next snowfall.
3. After a new snow has fallen on earlier snow, gently insert the measuring stick into the snow until it touches the snowboard. Take several measurements at different spots on the snowboard and average these measurements. This will be

your depth of new snow on the snowboard.

4. Measure total depth of snow on the ground at the same time as the daily accumulation. The procedure is the same as for measuring the first snowfall: insert the measuring stick vertically into the snow in several places (not in the area of the snowboard) and take the average of the depth readings.

Determining Liquid-Water Content of Daily Solid Precipitation

Not all snowfalls are alike. Some are light and fluffy while others are wet and heavy. The daily liquid equivalent of solid precipitation is determined by melting a sample of snow and measuring the volume of the water.

For this measurement, a collection container is necessary. When outside temperatures are below freezing, the plastic rain gauges used for liquid precipitation measurements may crack and break, so they should be brought indoors. However, the large, overflow cylinder of the rain gauge makes an ideal container to collect snow to determine liquid-water content.

1. Once you have measured the depth of daily snowfall on the snowboard, take the large cylinder from the rain gauge and invert it on the snowboard, pushing the cylinder down carefully so that it touches the board's surface. If the depth of snow is greater than the depth of the overflow cylinder, you may compact the snow in the cylinder. In doing this, be careful that you are not pushing snow out of the path of the cylinder. If the snow is too deep, you may not be able to compact the snow into the cylinder as a single sample. Depending on the size of your snowboard and the depth of snowfall, there are at least two ways to get that circle of snow into your cylinder.

Method A

If your snowboard is not large or heavy, hold the cylinder against the board and invert both snowboard and the cylinder. This will cause the snow outside the cylinder to fall off the board, so be sure you've made your depth measurement first. The snow trapped in the cylinder can now be taken indoors.

Method B

If your snowboard is too big or heavy to turn over easily or if the snow column, even when compacted, will not fit into the cylinder, you will have to transfer the snow into the cylinder or other container by hand. Carefully lift the cylinder off of the board and you should have a nice circle of snow in the shape of the cylinder. Carefully scoop the snow from within this circle into your cylinder or other container.

2. Once the snow is inside the cylinder or other container, bring it indoors and allow it to melt. Place a cover over the container to prevent evaporation.
3. When the snow has melted, carefully pour the water into the measuring tube of the rain gauge and read the depth of water in the same way you read the rainfall.

It is possible that an overnight snowfall may melt before the daily precipitation measurement is made. If you have left your overflow cylinder outside, you can still report the liquid water equivalent of your snowfall. Enter "M" for Daily depth of new snow and 0.0 mm for Total depth of snow on the ground. In cases like these a message can be entered under comments noting that snow fell and melted or blew away. If you have measured the depth of snow before it melted, this could also be reported under comments, along with the time you made the measurement. Remember that measurements reported in the regular section of the data sheet should be the measurements taken within one hour of local solar noon.



Setting Up for the Next Measurement

After you have completed your snow observation, clean the snowboard and again place it flush on the snow's surface



Data Submission

Report the following information to the GLOBE Student Data Server:

Date and time of data collection (in Universal Time)

Total depth of snow on the ground (mm)

Daily depth of new snow (mm)

Number of days snow has accumulated on the snow board

The depth of water from the melted snow on the snowboard (mm).

Note: If snow has fallen but, for some reason, measurements cannot be taken (for example, the snowboard has blown away or someone accidentally cleared it before a measurement could be taken) then enter the letter "M" (for missing). The total snow depth can still be reported.

On days when the snowfall is so small that a depth cannot be read, enter the letter "T" (for "trace") for the daily snowfall.

It is important to take daily readings of snowfall, but if this is not possible, then, if the snowfall has not been measured for several days (for example over the weekend), enter the number of days since the snowboard was last cleared along with the amount of snowfall. This indicates that the measured amount was collected over more than a 24-hour period. Thus, for example, if you missed reading the snowboard on Saturday and Sunday but read it on Monday, you would enter 3 days for Monday along with the actual reading.

